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# Overall progress achieved since the United Nations Conference on Environment and Development

## Report of the Secretary-General

## Addendum

## Protection of the atmosphere*

(Chapter 9 of Agenda 21)

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* The report was prepared by UNEP as task manager for chapter 9 of Agenda 21, in accordance with arrangements agreed to by the Inter-Agency Committee on Sustainable Development (IACSD). It is the result of consultation and information exchange between United Nations agencies, international and national scientific organizations, interested government agencies and a range of other institutions and individuals.

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## INTRODUCTION

1. This report reviews progress made in the implementation of the objectives set out in chapter 9 of Agenda 21 (Protection of the atmosphere),[1] taking into account the decisions taken by the Commission on Sustainable Development on this subject at its fourth session, in 1996. The protection of the atmosphere was, in chapter 9 of Agenda 21, considered as a broad multidimensional endeavour involving various sectors of economic activity. The Commission on Sustainable Development at its fourth session, noted that non-sustainable development and use in the energy and other sectors is linked to environmental and societal problems, including air and water pollution, health impacts and global warming. The Commission also noted, among other concerns, the rapid growth in the transport sector resulting in a concomitant increase in energy requirements in both industrialized and developing countries and also encouraged Governments to address the growing problem of transboundary air pollution.

## I. KEY OBJECTIVES

2. The impact of energy production and consumption and of transportation on atmosphere, particularly global climate change, has been chosen as the key objective for this report, in view of the relative emphasis on these sectors by the Commission on Sustainable Development after having considered the key linkage between energy and sustainable development. The other issues of stratospheric ozone layer, transboundary atmospheric pollution and land-use are also briefly mentioned.

3. Energy is essential to economic and social development and improved quality of life. Much of the world's energy, however, is produced and used in ways that could not be sustained if technology were to remain constant and if overall quantities were to increase substantially. The need to control atmospheric emissions of greenhouse and other gases and substances will increasingly need to be based on efficiency in energy production, transmission, distribution and consumption, and on growing reliance on environmentally sound energy systems, particularly renewable sources of energy.

4. The transport sector has an essential and positive role to play in economic and social development, and demand for transportation will undoubtedly increase. However, since the transport sector is a source of atmospheric emissions, there is need to review existing transport systems in order to design and manage traffic and transport systems more effectively.

### A. Energy production and consumption

5. Energy-related $CO_2$ emissions - those produced by burning fossil fuels - continue to increase with rising consumption of fuel, particularly petroleum products, by the transportation sector and coal burning at electric utilities. The greatest sources of $CO_2$ emissions in 1994 in countries that are members of the Organisation for Economic Cooperation and Development (OECD) came from these sources.

6. World commercial energy production and consumption continued to increase and in 1995, the most recent year for which reliable data are available, petroleum consumption worldwide was almost 68 million barrels per day, the majority of which, over 40 million barrels, were consumed by OECD countries. Also, increasing consumption of coal reached about 3.3 billion metric tonnes in 1995, up 1.2 per cent from the level of consumption in 1994. On average, developing countries accounted for a third of world commercial energy consumption in 1995.

7. Globally the carbon intensity of energy (gC/MJ) continues to decline at about 0.3 per cent a year, with slight increases in energy intensity (MJ/GNP). The extent to which the world is dependent on energy for economic output has declined by about 1 per cent a year. However, the growth in world economic output has outpaced these effects, resulting in increased global emissions of carbon dioxide ($CO_2$).

8. In addition, methane ($CH_4$) emissions from coal mining and natural gas venting, as well as leakage from pipeline and distribution systems, are significant. It has been estimated that the coal industry worldwide contributes 4-6 per cent of global methane emissions. Flaring and venting has been estimated to be about 5 per cent of world natural gas production.

## B. Transportation

9. The transport sector, including passenger travel and freight movements by road, rail, air and water, was responsible for about 25 per cent of 1990 world primary energy use and 22 per cent of $CO_2$ emissions (1,200 million metric tonnes of carbon - MtC) from fossil-fuel use. It is one of the most rapidly growing sectors. Motor vehicles alone account for 14 per cent of world emissions of carbon dioxide.

10. Energy use in 1990 in the transport sector was estimated to be 61-65 EJ. At current growth levels, this might increase to 90-140 EJ in 2025. Developed countries are expected to continue to generate the majority of transport-related greenhouse gas emissions until 2025. After 2025, total transport-related emissions from developing and transition economies may exceed that of the developed economies.

11. Energy use for freight increased in every country on a per capita basis and increased relative to gross domestic product (GDP) in the United States and OECD-Europe. On average, more energy was required to move 1 ton 1 kilometre in 1993 than in 1970 because of the increasing role of trucks in freight hauling compared with rail.

12. Nitrogen oxides ($NO_x$) forming ground-level ozone are also the result of road and air transport and electricity generation, in that order of importance.

## C. Other concerns

13. Analysis of scientific data confirmed the depletion of the Earth's stratospheric ozone layer by reactive chlorine and bromine from man-made chlorofluorocarbons (CFCs), halons and related substances. The Montreal Protocol with its subsequent amendments and adjustments is widely viewed as a landmark for international cooperation and embodies many of core principles of Agenda 21. International action was taken after observed ozone depletion but in advance of observed impacts on human health or ecosystems. Thus, although earlier international action would have been desirable, the Protocol provides an example of the precautionary principle in action.

14. Nevertheless, the risk of ozone depletion is likely to continue to increase for the next three or four years and recovery of the ozone layer is projected to take 50 years or more. Health and environmental impacts are projected to continue even longer.

15. Transboundary air pollution has adverse health impacts on humans and other detrimental environmental impacts, such as tree and forest loss and the acidification of water bodies. The geographical distribution of atmospheric pollution monitoring networks is uneven, with developing countries severely under-represented.

16. For example anthropogenic emissions of sulphur and nitrogen oxides - mainly from fossil fuel combustion - have led to an increased acidity of aerosol particles, cloud water, and precipitation in and around industrialized regions in the past. Acid deposition, as well as direct effects of gaseous air pollutants, is causing widespread damage to aquatic and terrestrial ecosystems in these regions. With increased industrial activity in developing countries such emissions are increasing.

17. Projections have also been made which suggest that global production, usage and release of persistent organic compounds (POPs), such as PCBs, dioxins and furans, will increase in the future, posing potential environmental and health risk at locations far from the source. In some cases the effects can persist for many decades to millennia even after corrective measures are implemented.

18. Land-use changes also accounts for about one fifth of the annual increase in anthropogenic greenhouse warming, mostly due to methane ($CH_4$) and nitrous oxide ($N_2O$). The atmospheric concentration of methane has the highest growth, though compared with $CO_2$ it stays in the atmosphere for considerably less time.

## II. SUCCESSES

### A. Energy production and consumption

#### 1. Quantitative and qualitative improvements

(a) Trends in control of emissions

19. Success since the United Nations Conference on Environment and Development has been limited. World total energy production and consumption and resulting $CO_2$ emissions continue to rise. However, there are some positive trends. Energy intensity is improving and carbon intensity of energy is declining as noted above.

20. There is also a worldwide trend towards increasing competition in the electric power sector. This will be generally helpful to small, high efficiency, and more economical co-generation systems, while discouraging large, less efficient, and less economical stand-alone steam turbine based power plants. As one of the results of the stress on increased efficiency, the use of natural gas increased by about 2.6 per cent in 1994, leading to a relative reduction in carbon emissions because natural gas is significantly less carbon intensive than coal and petroleum.

(b) International level

21. Progress has been made. Parties to the United Nations Framework Convention on Climate Change (UNFCCC) have agreed to negotiate a protocol or other legal agreement to limit greenhouse gas (GHG) emissions in industrialized countries (Annex I Parties) after the year 2000.

22. Countries have agreed to launch a pilot phase of Activities Implemented Jointly (AIJ) until the year 2000. Those countries involved in the pilot stage are actively contributing to a reduction in $CO_2$ emissions without an expectation of credits against their national emissions. For example, electric utilities in the Netherlands and in North America and members of the World Business Council for Sustainable Development (WBCSD), through AIJ under the UNFCCC, are transferring technology to developing countries or offsetting $CO_2$ emissions by contributing to the planting of forests. No carbon credits are allotted. Other potential donor countries have been reluctant to become involved in the pilot phase because of what they consider a lack of incentive.

(c) Domestic level

23. The political will to address the problem of greenhouse gas emissions is increasing in many countries. Many industrialized countries are debating possible targets for GHG emissions and domestic policies and measures to meet these targets. However, few countries have actually proceeded further than that.

24. There is a noticeable shift in government research and development (R&D) budgets globally from the fossil energy sector to energy conservation and renewable energy according to the 1995 International Energy Agency (IEA)

statistics. While the R&D budget for fossil energy decreased from US$ 1.07 billion in 1992 to US$ 0.98 billion in 1994, the same period witnessed R&D in energy conservation increasing from US$ 0.56 billion to US$ 0.94 billion; and in renewable energy it was about US$ 0.70 billion a year in 1993 and 1994. However, it should be noted that since 1983, the government and private sector R&D budgets in the energy sector have declined considerably, except in the case of energy conservation, which registered an increase.

25. Consumption of nuclear energy, a comparatively carbon-free source of energy, has increased by 4 per cent from 1994 to 1995, increasing its contribution to 7 per cent of world primary energy. Public concerns about nuclear safety, environmental risks regarding disposal of nuclear waste, and concerns about nuclear proliferation remain high.

## 2. Contributing factors

### (a) Institutional

26. There is an increasing trend among Governments towards reducing or eliminating subsidies to the fossil fuel industry, leading to a pricing structure that better reflects the true costs of energy. This has resulted in the promotion of efficiency in energy production and use.

27. One motivating factor contributing to increased energy efficiency and renewed interest in renewable energy systems is supplied by the UNFCCC. The Convention may not yet have resulted in an agreement on a timetable to cut back on GHG emissions, but the likelihood of a protocol to that effect being initiated is clear to most Governments. The increasing number of initiatives related to Activities Implemented Jointly (AIJ) is another indication of the impact of the UNFCCC.

28. Annual worldwide investments in energy supply systems are of the order of US$ 150 billion. However, within a period of 50 to 100 years, the entire energy supply system will be replaced at least twice. New investments to replace old plants or to expand capacity are opportunities to adopt technologies that are more environmentally friendly at low incremental costs.

29. The Global Environment Facility (GEF) has been created to, among other objectives, stimulate the implementation of cleaner energy systems in developing countries. Since its inception, GEF has spent US$ 466.59 million on assisting developing countries to identify the sources of GHG emissions in their countries and introducing efficiencies to avoid future increases.

### (b) Attitude changes

30. Moderate changes in attitudes in confined sectors of society can be noticed, resulting in a choice of more energy-efficient products. Few manufacturers highlight this aspect in their advertisements, reflecting only slight consumer preference for such products, even if for cost-saving reasons.

(c) Action by major groups

31. Opposition to large electric power plants the world over for environmental and social reasons, has put pressure on Governments to rethink such projects. There have been public protests led by non-governmental organizations against GHG-emitting coal-fired power projects, as well as protests directed against non-GHG-emitting hydroelectric schemes because of environmental issues other than global warming.

(d) Wider societal trends and their causes

32. There is increased public and political awareness of local air pollution impacts of fossil fuel burning in many cities. Increased production and use of fossil fuels, especially coal, the most abundant and carbon intensive fossil fuel, can have severe local and regional environmental impacts. Locally, air pollution already takes a significant toll on human health. Acid deposition and other forms of air pollution can also degrade downwind habitats - especially lakes, streams and forests - and can damage crops, buildings and other materials. For example, a study by the World Energy Council and the International Institute for Applied Systems Research (IIASA) points out that in the absence of sulphur-abatement measures, acid depositions in parts of China and South Asia could eventually exceed the critical load for major agricultural crops by a factor of 10.

(e) Other

33. Shortages of investment capital to build energy production and distribution facilities may act to restrain global energy consumption, especially in developing countries. The cost of the energy infrastructure required to meet the development goals of developing countries is estimated in the trillions of dollars over the next two decades - a sum far higher than present investment levels can finance. This adverse development phenomenon in developing countries has limited the emission of GHGs. As developing countries industrialize, emissions are likely to increase. At the same time, the shortage of capital could, in the long term, provide opportunities to explore cheaper and more environmentally friendly alternatives.

## B. Transportation

### 1. Quantitative and qualitative improvements

34. Governments are increasingly aware of the environmental and other problems associated with the growing demand for transport. Several initiatives are being taken or being considered: to promote the use of cleaner transport fuels, to encourage the use of public transport, to combat traffic congestion, and the like.

35. The Economic Commission for Europe (ECE) will hold an important regional conference on transport and the environment in 1997. Preparatory meetings have identified objectives and measures acceptable to all ECE member Governments for reducing the environmental effects of transportation.

36. In the United States of America an advisory committee was established by the President to recommend options for reducing greenhouse gas emissions from private motor vehicles. This group submitted its report in October 1995, recommending policies for returning United States car and light truck emissions to their 1990 levels through fuel economy, reduction of vehicle miles travelled (VMT) and use of alternative fuels.

37. There have been examples of civil authorities, active members of the International Council for Local Environmental Initiatives (ICLEI), taking action at the local level to decrease air and noise pollution related to transportation, which also results in energy efficiency and lower GHG emissions per kilometre. For example, in 1990 Singapore reduced its gasoline consumption by about 42 per cent by taking severe fiscal and other measures to control its traffic problems. However, motor gasoline consumption in Singapore has been increasing since, and during 1990-1993 it increased by about 2.3 per cent annually.

38. Research on future engines, including electric and hybrid vehicles, and alternative fuels is under way. While a great deal of such work is carried out by the industry, particularly in OECD countries, several Governments - for example, in Belarus, the Czech Republic, Finland, the Netherlands, Norway and the United Kingdom of Great Britain and Northern Ireland, undertake research individually or in cooperation with industry and independent institutions or, alternatively, sponsor such work.

39. With regard to the introduction of cleaner fuels, several countries, particularly in Eastern Europe - for example, the Czech Republic, Hungary and the Russian Federation - indicate that they have introduced gas and/or gas/diesel-fuelled road vehicles. However, in these countries the high fixed cost of petroleum fuels tends to discourage car use. In the air transport sector development of aircraft using liquefied natural gas and helicopters propelled by condensed associated gas is under way in the Russian Federation, including the development of a significantly more economical and fuel-efficient aircraft engine and airframe. The Russian Federation is also undertaking a programme of fuel/energy savings intended to yield important fuel savings in the maritime transport sector.

40. Economic measures to reduce $CO_2$ emissions are applied in Liechtenstein, Norway, Sweden and Austria. A $CO_2$ tax is applied to fuel prices in Norway, Denmark, Finland, the Netherlands and Sweden; and in Norway and Denmark, there are also taxes on gas, oil and coal. In Sweden, the gasoline tax has been sharply increased in the last few years, mainly for fiscal reasons. In Austria, the former luxury tax on new road vehicles has been split into a fixed part and variable part that depends on a vehicle's fuel consumption. In the United Kingdom, the Government increased road fuel duties by 8-10 per cent in 1994 and foresaw future annual increases averaging at least 5 per cent in real terms. The taxes provide fiscal revenue, and apparently are increasingly being applied to promote cleaner vehicles and fuels and to regulate demand.

41. Several measures to promote alternatives to cars and trucks are being promoted throughout Europe. Public passenger transport is being promoted by several European countries through fiscal incentives, investment aids and

organizational measures to reduce the density of road traffic. Several Governments - for example, Germany, the Netherlands, Norway and Austria - also promote the use of bicycles and provide grants and aids for that purpose. Discouraging car use through pricing and parking charges is carried out in several countries.

42. In several developing countries, major transport infrastructure projects are subject to Environmental Impact Assessment (EIA). Currently many developing countries are placing emphasis on "end of pipe" approaches to address the problem of air pollution through introduction of vehicular emissions standards. A few countries - for example, Thailand, Indonesia and Pakistan - are also considering the use of compressed natural gas as an alternative to gasoline.

43. Most countries that are members of the European Union (EU) have declared that, instead of freezing nitrogen oxides ($NO_x$) at 1995 levels according to the Sofia Protocol, they will decrease their emissions by 30 per cent. However, the general growth in private car use and in road transport suggests that only a few countries will be able to reduce their national emissions by the announced 30 per cent.

## 2. Contributing factors

### (a) Institutional

44. Travel by bus, train, foot or bicycle involves lower greenhouse gas emissions per kilometre than does travel by car. This is now recognized by Governments worldwide, though attempts to reform the transport policies to reflect this occurs primarily in OECD countries. However, once changes take place in these countries an expansion to developing countries is also likely to be witnessed.

45. The European Community has formulated the concept of sustainable mobility as a guide to transport policy with a view to ensuring sustainable and environmentally sound mobility for persons and goods. The North American countries, with low population densities and high-capacity motorways and without major congestion problems except in large urban areas, base their strategies mainly on the adoption of strict environmental requirements for transport vehicles. Transport demand management programmes have also been introduced in certain urban areas.

### (b) Attitude changes among consumers

46. National measures to address the environmental impacts of the transportation sector are forced by the reaction of its citizens. For example, Bangkok, London and Tokyo did not address automobile emissions until residents complained of the worsening air pollution situation in these cities. More and more city dwellers are expressing concern about the decreasing quality of air due to transportation and are demanding action.

(c) Actions by major groups

47. Local environmental impact is increasingly an issue being taken up by local environmental groups highlighting the environment-transportation linkages. For example, a group in Thailand uses the Internet for monitoring growth and problems of traffic in Bangkok. Additionally, an international pressure group on transportation policies and several researchers are looking at alternative modes of transportation and appropriate urbanization patterns.

(d) Wider societal changes

48. Awareness of local air and noise pollution remains the driving force to regulate increasing emissions from the transport sector. Long-term policies that reduce noise and air pollution also result in the reduction of GHG emissions.

## C. Other concerns

49. Global production and consumption of the major ozone-depleting substances (ODS) has decreased markedly. Observations show a slowing, and in some cases a reversal, of the increases in atmospheric concentrations of major ODS.

50. Actions to address national issues in developed countries and agreements among industrialized countries have led to a reduction in transboundary air pollution and its impacts. Reductions in emissions that cause acid deposition and tropospheric ozone are being achieved despite increasing industrialization and transportation. The trend is towards continuous improvement in reduction of environmental impact due to transboundary atmospheric pollution in these countries.

51. A number of projects to conserve and sequester carbon are now being jointly implemented between industrialized and developing countries. They vary from carbon conservation by protecting forests or developing sustainable forest management practices to increasing carbon pools through afforestation and agroforestry.

# III. PROMISING CHANGES

## A. Energy production and consumption

### 1. Government policies

52. A worldwide trend now exists to reduce subsidies, which is leading to increased energy efficient production, transmission and consumption. Additionally, privatization of energy production is providing opportunities for more efficient decentralized energy production systems, in particular in Central and Eastern Europe.

53. New technological development is another source of promise in the future. The contribution to global electricity supply by such new technologies as

advanced biomass-electric generation (biomass-integrated gasifier/gas turbine technologies through 2025 and biomass-integrated gasifier/fuel cell technologies for 2050 and beyond) could reach one sixth of the total supply from 2025 to 2050, and more later. There is no net atmospheric $CO_2$ build-up from using biomass provided that it is regenerated; $CO_2$ released in combustion is compensated for by that absorbed from the atmosphere during regrowth.

54. The World Solar Summit, attended by 20 Heads of State or Government and a large number of ministers, in September 1996, approved an outline for a World Solar Programme 1996-2005, committing the Governments to work towards a wider use of solar energy.

55. Available technology can reduce methane ($CH_4$) emissions from coal mining by 30-90 per cent, from venting and flaring by more than 50 per cent, and from natural gas distribution systems by up to 80 per cent. Options for limiting emissions from coal mining; natural gas production, transmission and distribution; and landfills may be economically viable in many regions of the world, providing a range of benefits - including the use of the captured $CH_4$ as an energy source.

### 2. Financing

56. As a consequence of environmental concerns, the World Bank has taken a public stand to stress energy efficiency and environmentally sound energy technologies. Though this policy was still not reflected in disbursements of loans in 1995 and 1996 except in a few small countries, a programme funded by a consortium of donors and the World Bank advanced a solar initiative that aims to introduce the use of highly efficient, up-to-date, solar technologies in developing countries. Identification and preparation of solar and renewable energy projects are under way in at least 14 countries, including Bolivia, Cameroon, Indonesia, Kenya and Mali.

### 3. Major groups

57. Non-governmental organizations (NGOs) and international organizations, including the United Nations Environment Programme (UNEP), have been very active in challenging large polluting power projects and have articulated the need for decentralized and environmentally clean sources of energy production, as well as focusing on demand-side management. This has led to a noticeable impact on policy makers in several countries. Currently, the environmental NGOs are also working with the World Bank to influence its energy policy document.

## B. Transportation

### 1. Government policies

58. Increased realization of traffic congestion and health impacts of air pollution in major cities around the world is helping push civic authorities to invest more in public transport. Several Governments, such as China, Cuba,

Denmark and the Netherlands, actively promote bicycling to work by improving safety conditions for cyclists and creating links with public transportation.

59. Another promising area for reducing GHG emissions is the increasing stress on telecommunications and information technology. In spite of the obstacles to its general adoption, the idea of substitution of telecommunications for transport in an urban environment remains relevant and may potentially reduce $CO_2$ emissions.

### 2. Financing

60. The World Bank, which disbursed more than US$ 10 billion between 1993 and 1996 on transportation, has now prepared a policy entitled "Sustainable transport". Based on this, a work programme has been developed on three themes of economic, social and environmental sustainability dealing with the concept of energy intensity of transport modes and the role of energy policies in affecting demand for transport.

## C. Other concerns

61. The provisions for review of the Montreal Protocol has provided the flexibility to adjust measures with improved information. The Multilateral Fund to provide financial and technical assistance for developing countries was replenished at the November 1996 meeting of the parties for another three years to maintain full participation of all countries in ozone protection, including developing countries and countries with economies in transition. Cooperation among Governments, environmental NGOs, the scientific and technical community and industry to fulfil the protocol objectives is also leading to rapid progress in addressing the issue.

62. Some developing countries - for example, in Asia - have initiated programmes to address transboundary air pollution, but information on the quantity and impacts of transboundary pollution is scarce.

63. Several countries have expressed interest in including carbon sequestration with sustainable forest management practices.

# IV. UNFULFILLED EXPECTATIONS

## A. Which areas show no progress since the United Nations Conference on Environment and Development?

64. Most industrialized country $CO_2$ emissions continue to rise, and very few of these countries are likely to reach their current UNFCCC targets of stabilization of GHG emissions at 1990 levels by the year 2000. Efforts undertaken until now have been modest, as have the successes. Enormous efforts have to be made by Governments to reform their energy and transport-related policies and provide the needed market signals to ensure that the moderate successes achieved are strengthened on a long-term basis.

65. For example, the focus until now has been limited to providing narrow technological solutions, which at times create other problems such as flue gas desulphurisation installed on an electric power station reducing the overall efficiency. Movements are few and far between for strong fiscal mechanisms to make such fundamental changes as reducing energy demand and energy intense transportation. Similarly, no significant move has been made to invest more in promoting renewable energy systems. According to the World Energy Council, total investments needed for R&D on, and in support of, initial deployment of renewable energy systems will be US$ 15-20 billion, while the annual government expenditure remains only US$ 0.7 billion.

### B. What are the specific obstacles in achieving progress?

66. Actions conducive to a transition to low $CO_2$ emitting energy technologies require such policy changes as energy system planning and technology research and development, which are not forthcoming globally and are confined to so few countries and are so limited in scope that they cannot have the desired global impact.

67. Governments and markets have been unable to incorporate environmental externalities in the energy and transport sector, limiting efficient use. Since no major international effort exists to do this, few countries, even those interested in such policies nationally, fear that it will make them internationally uncompetitive.

68. Without fiscal intervention by Governments through taxation based on carbon content, the low fossil fuel prices in the world market remain an obstacle to emission reduction.

69. There are some disturbing new trends, however. An illegal trade in chlorofluorocarbons (CFCs), the largest contributors to ozone depletion, has developed. Moreover, in a number of developing countries, the consumption of CFCs continues to increase.

70. Given the competition for scarce resources to be allocated among different environmental issues, it is not easy for many developing countries to give transboundary atmospheric pollution issues sufficient priority.

## V. EMERGING PRIORITIES

### A. Potential opportunities for removal of obstacles through integrated management across all environment and development issues

71. In the energy supply sector, GHG emissions can be reduced by introducing low $CO_2$ emitting energy supply systems, such as more efficient conversion of fossil fuels; switching to low carbon fuels; decarbonization of fuels; and increasing the use of renewable sources of energy. A number of new concepts with higher electricity production efficiencies and lower emissions are being developed based on combined cycle processes. This requires, besides government

policy intervention, the use of economic instruments such as tradeable emissions permits and emissions fees (taxes) to partly incorporate the true social and environmental costs of existing technologies in the price of the energy that is produced. Also required is further promotion of demonstration projects for new energy conversion systems and their subsequent implementation - for example, the ECE Energy Efficiency 2000 Project.

72. The greatest single barrier to solving transportation problems effectively, regardless of city size and location, is the fact that the responsibility for urban transportation systems resides with many different entities. Typically, one institution is responsible for air quality management, another is in charge of traffic management, a third manages public transportation, and a fourth manages the infrastructure. A few city authorities, by coordinating the transportation system in their region, have been able to introduce a package of measures to reduce energy use by 20 to 40 per cent.

73. Travel-mode switching from car to bus, rail or other mass transportation systems can reduce primary energy use by 30 to 70 per cent, while switching container freight traffic from road to rail can reduce primary energy use by 30 per cent. However, the political will to promote these fundamental changes is still not evident, and most of the effort remains on technical fixes related to more efficient vehicles and not on a major shift from private to public transport systems.

74. There is an urgent need for developing countries to formulate agreements to control transboundary atmospheric pollution before it seriously impacts on the environment and on the health of people.

75. The most effective long-term (more than 50 years) ways in which to use forests to mitigate the increase in atmospheric $CO_2$ are to substitute fuelwood for fossil fuels and wood products for energy-expensive materials. In addition, over the next 50 years or so, substantial opportunities will exist to conserve and increase the carbon store in living trees and wood products through reafforestation and rehabilitation programmes.

76. Better management of paddy fields and improved nutrition of ruminant animals can lead to a significant decrease in $CH_4$ emissions from agriculture. Additional $CH_4$ decreases are possible through altered treatment of animal wastes.

### B. Improvement in awareness and understanding of the specific obstacles since the United Nations Conference on Environment and Development

77. Most of the international energy-related conferences include consideration of environment and sustainability, reflecting a general increase in awareness. Additionally, more and more developing country Governments are formulating long-term energy policies consistent with their national environment action plans (NEAPs).

78. The ECE is developing a convention on public participation in relation to environmental decision-making, which is expected to be signed at the 1998 ministerial conference in Copenhagen.

79. In transportation, local air and noise pollution is being increasingly recognized as a problem in virtually all the major cities in the world.

80. While public awareness is increasing in most countries, the pressure on policy makers so far has not been sufficient to ensure far-reaching changes. It is still not recognized that change can also lead to new opportunities. Currently, most of the debate is on the costs of change and who should bear it.

## Notes

[1] Report of the United Nations Conference on Environment and Development, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

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# Overall progress achieved since the United Nations Conference on Environment and Development

## Report of the Secretary-General

## Addendum

## Integrated approach to the planning and management of land resources*

(Chapter 10 of Agenda 21)

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* The report was prepared by the Food and Agriculture Organization of the United Nations as task manager for chapter 10 of Agenda 21, in accordance with arrangements agreed to by the Inter-Agency Committee on Sustainable Development (IACSD). It is the result of consultation and information exchange between United Nations agencies, international and national science organizations, interested government agencies and a range of other institutions and individuals.

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# I. KEY OBJECTIVES

1. This report reviews progress made in the implementation of the objectives set out in chapter 10 of Agenda 21 (Integrated approach to the planning and management of land resources),[1] taking into account the decisions taken by the Commission on Sustainable Development on this subject at its third session, in 1995. The principle objective of chapter 10 of Agenda 21 is the promotion of an integrated approach to the planning and management of land resources. This is to be achieved by a mix of management-related activities, support of data and information systems and international and regional coordination and cooperation. As the chapter deals with an important cross-sectoral aspect of decision-making for sustainable development, it is closely related to a number of other chapters of Agenda 21, particularly those in sections II and IV thereof.

2. In more specific terms, the objectives of chapter 10, which were given time-frames for implementation, are as follows:

(a) To review and develop policies to support the best possible use of land and the sustainable management of land resources, by not later than 1996, (the terms "land" and "land resources" are here understood to be used in a general and comprehensive sense, and to include for example, water, flora, fauna and other natural resources related to land);

(b) To improve and strengthen land planning, management, and evaluation systems, by not later than the year 2000;

(c) To strengthen institutions and coordinating mechanisms for land and land resources, by not later than 1998;

(d) To create mechanisms to facilitate the active involvement and participation of all concerned stakeholders, by not later than 1996.

3. The first of the above objectives is the most important of the four, since it will perform the key integrative function which ensures that all inputs and activities are combined. The absence of an integrated approach to land resources management, both for production and for conservation, is the single most important failure today, in both developed and developing countries. The immediate cause of this almost always appears to be institutional, as the development and evolution of human institutions - for information-gathering and assimilation, for negotiation and decision-making, for provision of services and implementation - has seriously lagged behind the growth of populations, technology, and social and economic needs.

# II. SUCCESSES

## A. Development of policies and methodology

4. Many countries have developed, or are in the process of developing national environment policies. However it is necessary that these should not remain as policies only, but should be translated into practical programmes of

implementation. Assistance in this area has been provided by the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme (UNEP) under a joint project to develop a holistic structural framework which combines stakeholders, information and institutions with incentives to produce and to conserve. The starting point is the knowledge that production will increase in proportion to the extent to which constraints are removed and incentives are offered, and that users will conserve resources where it is made in their interests to do so. Secondly, resource use will be most efficient when it is managed through stakeholder negotiation, and when all stakeholders are provided with adequate information as a basis for negotiation and decision-making. For this to take place, appropriate institutional frameworks and information systems need to be established. In this regard, special attention needs to be paid to stakeholder groups which are at present disadvantaged in terms of ability to negotiate on equal terms.

5. It is recognized that decisions and negotiations on the use of essentially the same basic resources take place at many social and institutional levels, from farm level to global level, and that the negotiating and decision-making structures must be integrated both horizontally and vertically in terms of allocation, needs and objectives. The term "land-use planning", which in the past has referred mainly to spatial planning of physical resources, and to planning alone, often in a top-down setting, is in many ways no longer appropriate or adequate to describe an all-encompassing and holistic framework which combines all aspects of the process of land (and associated resources) management for maximum sustainable production and for the satisfaction of all other human needs, such as shelter and the preservation of biodiversity.

6. Under the joint FAO/UNEP programme, two expert consultations were held during 1995. The above principles were fully developed, and embodied in practical proposals. Three publications describing the approach are under preparation. The new approach is already being discussed, and is beginning to be adopted by a number of countries. It will be further developed and publicized at several future workshops and conferences. While it will probably be a number of years before the principles become universally known, and are adapted and widely applied, there are good grounds for optimism in this regard.

## B. Planning, management and evaluation systems

7. Decisions about land use involve optimizing the match between land resources and land use. Until now there has been no practical and internationally agreed system to precisely define land cover, land use, or production systems. This has been a serious constraint to the development of a global set of detailed statistics, which in turn has made the monitoring of changes in land use and land cover difficult. Lack of a conceptual framework to describe and define land use and cover has also been one of the most serious constraints in relation to the identification of viable alternatives, or improvement of present land use and production systems. Three years ago FAO and UNEP, in collaboration with national institutions, launched an initiative to develop a logical and practical system, for both definition and classification. The result of this work is scheduled to be published late in 1996. Software

packages for defining and storing both land-cover and land-use information, developed under the same initiative, were already available prior to this.

8. Despite these difficulties in definition and concept, however, a number of land resources information systems, particularly with respect to forest resources, have been developed. Geographical information systems, interfaced with databases containing information on land resources as well as social and economic information, are also being increasingly established in both developed and developing countries, sometimes even at the village level. Progress over the next few years in this area is likely to be rapid, although more so in those economies having greater access to financial and technological resources. Two aspects are at present driving the process: the rapid digitization of thematic maps at all scales and the linking of subject-matter to specific institutional databases. At the same time, availability to the public is sometimes limited by government regulations and by commercial enterprises wishing to sell information.

9. In relation to information, three key aspects need to be clearly understood. The first is that information to enable stakeholders of all classes to make rational decisions comprises more than just soil, climate and other physical data. It must also include information on potential markets, varieties of alternative crops, production systems, laws and regulations, availability and prices of inputs, and a number of other factors. Secondly, the information must be regularly available to all stakeholders, including those at the grass-roots level. This requires innovative thinking about development of appropriate information dissemination systems. Thirdly, availability of information must be combined with appropriate education and training on how to use and analyse it, and on how to negotiate on a more equal basis with other classes of stakeholders, such as commercial interests.

10. Governments need to be aware that they cannot by themselves shoulder the entire task of providing the whole range of necessary information at all levels. A very significant part has to be played by private sector organizations, such as commercial radio and television, newspapers, and stakeholder associations. The present rapid spread of information networks and Internet linkages throughout the world presents an opportunity to actively and purposefully disseminate the information and data necessary for logical decision-making and negotiation to all classes of stakeholders, including those who, up to now, have not been recipients.

11. The need for training and education in this general area needs to be emphasized. This includes training in the use and interpretation of information, as well as in the operation of information systems. An increasing number of computer software packages are becoming available for monitoring, mapping, and analysing land resources and land-use data at all levels. There is also an increasing availability of remotely sensed data to serve as inputs and raw material for thematic mapping, land-use mapping, and environmental monitoring.

## C. Institutions and coordinating mechanisms

12. The conception and implementation of land resources planning and management are complex undertakings requiring the participation of several ministries at the national level as well as of regional and local authorities and the private sector. Many of the existing institutional arrangements do not provide conditions which facilitate joint public-private activity or improve citizen participation and transparency in land management.

13. Much more progress is required in this general area, particularly with regard to the structure of government institutions. A first step would be the establishment of further horizontal linkages, which would promote the exchange of information and help to ensure a more integrated approach.

## D. People's participation

14. The need for the involvement of all those concerned with land use and management, particularly communities and people at the local level, is becoming more widely accepted day by day. A useful body of experience is being built up by Governments, non-governmental organizations, and development agencies in developing countries, and this is now beginning to be collected and analysed from the point of view of the types of structures that are the most successful in representing stakeholder interests in the long term, and how these can best be established. In some developing countries, limits on government resources have led to a devolution of responsibility from the central level, giving greater control to communities over the management of their local resources. Overall, the past few years have seen the establishment of a large number and wide range of local-level organizations active in the area of land (and associated resources) management.

15. An increasing number of practical programmes designed to involve local populations in resource management or to actually make them responsible for the process (as opposed to simply providing the opportunity for "consultation" in relation to programmes designed and implemented by Governments) are now being implemented. Some of the more successful original approaches, largely, though not entirely, occurring in developing countries, are now being fine-tuned and improved, and applied in a wider range of circumstances. Since the United Nations Conference on Environment and Development (UNCED), national-level programmes designed to encourage greater local participation in land-use planning and resource management, particularly with respect to forests, have been initiated, consolidated, or significantly expanded. Among them are the Model Forests Programme in Canada, Joint Forest Management in India, the Community Forestry Programme in Nepal and the Land Care Programme in Australia.

16. The World Bank's experience in Africa suggests that land resources should be managed at the lowest possible level, using demand-based approaches and involving stakeholders, particularly women, in decision-making. The Bank also makes the point that land should be treated as both a social and an economic resource. Many other organizations have come to the same conclusions, both on the African continent and in other parts of the world.

17. In a number of countries a greater effort has been made in recent years to provide the means for people to express their views on plans related to the use of public land or for regulating the use of private land. In addition, the past five years have produced a rapid increase in the number and strength of non-governmental organizations worldwide, many of which provide a means for reflecting local interests at the national and even international levels.

## III. PROMISING CHANGES

18. In including chapter 10 in Agenda 21, UNCED participants accepted the importance of promoting an integrated approach to all aspects of land resources management; since 1992, at the national level, the need to take action to implement this commitment has been increasingly recognized. Over the past few months alone, over 30 Governments have requested assistance in this area from FAO. National authorities are also becoming more open to discussing and considering more fundamental and radical options to land management, which may involve changing existing institutional structures which can often be a major constraint to effective action. The growing dialogue with interested Governments provides an ideal opportunity to further develop and test the proposed integrated approach to all aspects of land resources management put forward by FAO and UNEP, referred to above, and to draw donors, development agencies, and recipient countries into a partnership dialogue.

19. A number of countries have made practical and significant progress in the decentralization of power and the devolution of decision-making to levels that facilitate the involvement of the local population. This is resulting in greater accountability of government institutions at this level, and the beginnings of a demand-driven approach to the provision of services. There are also indications of a growing partnership between Governments and non-government organizations in development and land resources management, and a growing mutual understanding of the respective strengths and weaknesses of each side.

## IV. UNFULFILLED EXPECTATIONS

20. There is already considerable awareness of the importance of an integrated approach to the planning and management of land resources, and the rapidly growing interest in the proposals being developed jointly by FAO and UNEP on the basis of existing knowledge and past experience has been encouraging. It is to be expected, however, that a different approach to land resources planning will take some years to be disseminated and implemented worldwide, particularly since it may involve significant institutional change. The world community should therefore take a realistic attitude in terms of the necessary time-scale for the programme. Progress towards widespread adoption of the approach will, moreover, be affected by a lack of sufficient resources. The harsh economic climate in the period since UNCED has meant that available professional and monetary resources have actually decreased drastically over the period, rather than increasing to reflect the extra efforts implicit in the follow-up to the Conference. It has also affected the ability of the United Nations organizations concerned to develop the institutional linkages necessary for a more rational combined approach to this work.

21. As noted above, while there has been a rapid development of land-related information systems in those economies having access to adequate financial and technological resources, information systems in many developing countries have been severely limited by the non-availability of basic natural resource data and information, by undeveloped market infrastructure, and by a lack of institutional capability. Furthermore, during recent years there has been a swing away from basic resource mapping, both on the part of the countries themselves and on the part of donors. There is now a need for such information for decision-making, by land users as well as by Governments, but it is in many cases not available. This, and the provision of equipment and training for information collection, including mapping, and system development, is an area in which donors could make very positive contributions.

22. In addition, for all countries, more complete information and the definition of several important concepts are required to accurately monitor the health of natural systems, or to design and apply land-use and management systems which are sustainable and appropriate under the different sets of physical, social and economic conditions which exist in the world. Two areas in which no international agreement has yet been reached are:

(a) Ecozones of the world, and their components, as a basis for monitoring environmental change and development of broad management guidelines and policies;

(b) Environmental condition indicators, which are not the same as sustainability indicators, but refer to the current status (or "health") of an environmental unit in the sense of its degradation or productivity status.

## V. EMERGING PRIORITIES

23. Increased population levels and unsustainable resource use have produced social and environmental problems which are among the most serious that society now faces. While global population growth rates seem to have stabilized in recent years, these pressures are still increasing, particularly in many parts of Africa and Asia, regions where food production requirements will likely be greatest over the coming half century. They argue for the need to devise and apply more efficient systems of resource management as the greatest emerging priority facing the world.

24. With the initial conceptualization phase of the FAO/UNEP joint initiative well on the way to completion, there is now a growing need for funding to support dissemination and discussion of the proposed integrated approach through conferences and workshops, and to support a rapidly expanding field programme of implementation. While it is recognized that donors have their own financial constraints, it is hoped that they will recognize the potential of an integrated over a dispersed approach, and will enter into a dialogue concerning the methodology which is being developed, in order to be apprised of its potential.

25. Chapter 10 has special relevance to all 14 chapters of section II of Agenda 21, and more than half of all the chapters of Agenda 21 mention or stress the need for land-use planning in one form or another. Other chapters, for

example 28, 38, 39 and 40, have special relevance for chapter 10. In the case of chapter 40 there are large areas of overlap and a particular need for an integrated approach, which is at present lacking.

26. Continuing rapid urbanization in developing countries is resulting in substantial land-use changes in the urban, peri-urban and even rural areas. The inability of planning functions and provision of services to keep ahead of urban population growth is manifested in the development of squatter settlements and slums; problems of pollution, water supply and waste disposal; and a host of social and economic problems. There is a growing need to integrate urban needs with those of the surrounding rural, or once rural areas; to assess changes in the peri-urban areas in response to rapid urbanization; to prepare strategies to meet the concentrated demands for food, energy and various material goods; to ensure that urban development proceeds in an environmentally sound manner; and to involve all stakeholders in urban development projects.

27. The need to prepare and continuously update plans to address the effects of natural disasters is also emerging as a priority. Such occurrences often result from the impact of local concentrations of human populations where activities such as deforestation trigger land slides or flooding. Alternative causes may relate to the more long-term effects on global systems and the environment.

## Notes

[1] Report of the United Nations Conference on Environment and Development, vol. I, Resolutions Adopted by the Conference (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

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